Air-cladded mode-group selective photonic lanterns for mode-division multiplexing - DTU Orbit (12/10/2019)

**Air-cladded mode-group selective photonic lanterns for mode-division multiplexing**

We have fabricated an air-cladded mode-group selective photonic lantern, which can (de)multiplex the first two mode groups of a standard two-mode step-index fiber. Instead of relying on a low-index capillary tube, our simple solution uses air to form the surrounding "cladding" and thereby enables guiding at the end of the taper. Characterization of a 25-mm long lantern taper results in multiplexing crosstalk values between -20 dB and -12 dB for both modal inputs. The de-multiplexing values were around -12 dB for the fundamental mode, and slightly higher for the first higher-order (LP11) mode. Microscopic imaging of a taper cross section having a width of 30 µm reveals the presence of an uncollapsed airhole in the structure between the three fibers. The impact of such an airhole is numerically investigated using an eigenmode expansion method based on a full-vectorial mode solver, and is found to play an important role in assuring a more adiabatic mode conversion through the taper.